Menlo Park Notebook #38 [N-79-07-07.2]

This notebook covers the period July 1879. Many of the entries are by Francis Upton. There are also entries by Edison, Charles Batchelor, and Francis Jehl. Material by Upton consists primarily of calculations relating to conductors, electric power distribution, and generators. Material by Edison includes notes and drawings of filaments and lamps; drawings and calculations relating to electric power distribution; notes on thermoelectricity experiments; notes on journal articles; and notes on induction coils for the telephone. There are also drawings by Batchelor of the telephone and notes by Jehl on wire tests. The book contains 282 numbered pages.

Blank pages not filmed: 148-149, 194-253, 256-273.

No 38

17
3
1

LIBRARY OF THE

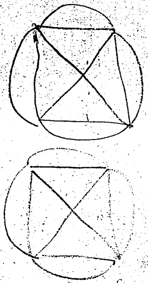
BOARD OF PATENT CONTROL,

120 BROADWAY, NEW YORK.

From Library
GENERAL ELECTRIC.
[illegible] Broad St. N. Y. C.

May 1, 1896.

No 38



8
8
16
16
32

Thermo experiments

Telephone lampblack tamped
in 1/4 inch tube 2 inch of lampblack
large copper wires fit tube
Thomsons 3/4 ohm Mirror-
heat candle, no apparant~~t~~ deflection
(Light unsteady galvanometer on table
walking disturbs it)

With Hyperoxide Lead, 350 deg
deflection - Equals Daniels
Cell through 840 ohms
to the left -

Iodide Copper about
200 deg to left =

Vapor of mercury does not attack gold at high temperatures, (or any metal perhaps) but when liquid it dissolves at once; Daniells - Phil Mag Vol 1 1832 page 263

Singular change of texture of platinum exposed to high temperature near plumbago — attributed by London Mfr of platinum to Sulphur to the French to presence of iron which "mere presence communicates a brittleness to platina. Daniel says plunged platinum in molten iron without change Daniels finally ascertained that it was due to Silica it takes up 3 per cent, a temperature considerably above melting point of cast iron is required to effect this Combination Descotils & Chenevix obtained this Combination of Pt with Silica by heating platina with blacklead ware — Boussingault found that there was no effect when Pt was heated with Lampblack
Daniell Phil Mag Vol. 1. 1832 - p 267

first string Telephone

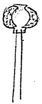
Chaldini Vol 4. Phil Mag.
page 118
of 1799 — two persons converse
by holding a stick in their teeth (&
upon teeth,) & close their ears -
also when thread was held in the teeth.

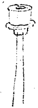
The use of a long wire same
purpose - page 379 Vol 14
Phil mag. 1799 — by
D Whyte —

Giessler tubes first spoken
of - Phil Mag Vol. 6 of 1800.
page 246 - Tremery

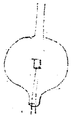
17
3
51

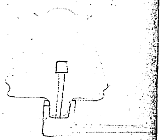
17
20
340

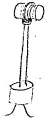


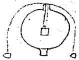


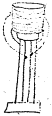
Bobbins of Hydraulic pressed, alumina, Silica, Zirconi and oxides of the cerium group – Magnesia, Calcium, Carbon –

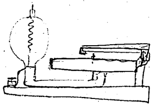


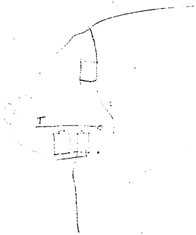


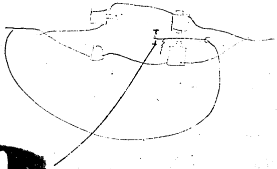


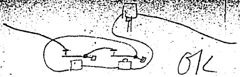












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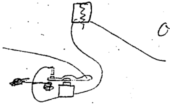

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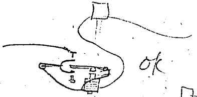

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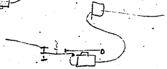

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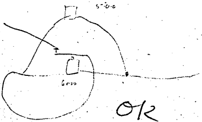

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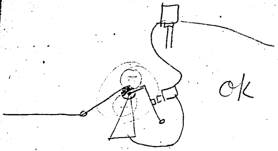

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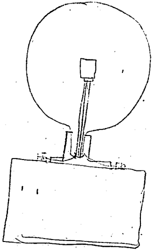

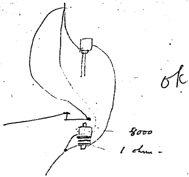

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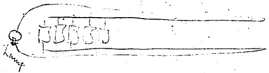
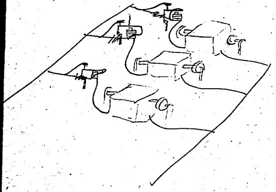
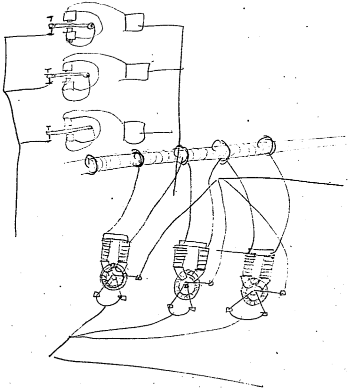




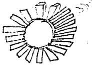


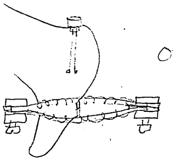
4 0

400

25

16
3 $\frac{1}{3}$





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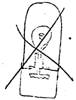
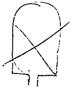
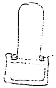
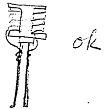





Expanding metal

ok -



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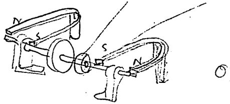

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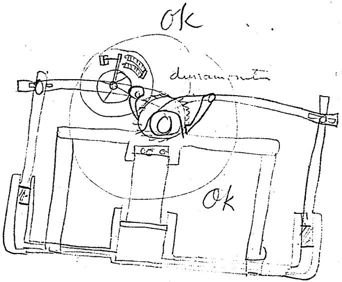
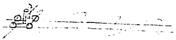

Ok
dynamometer
Ok

get the diagrams
relating to the rubber
Engine =



after winding each layer of pyromantled wire cover the whole with pyromantlem & then wind the other layer.

$x^3 - 8x^2 + 19x - 14)$

$x^4 - 7x^3 + 8x^2 + 28x - 48$

$x^4 - 7x^3 + 8x^2 + 28x - 48 \;\;)x^3 - 8x^2 + 19x - 14$

$x^4 - 8x^3 + 19x^2 - 14x \;\; x + 1$

$x^3 - 11x^2 + 42x - 48$

$x^3 - 8x^2 + 19x - 14$

$-3x^2 + 23x - 34$

$x^3 - 8x^2 + 19x - 14 \;\; -3x^2 + 23x - 34$

$3x^3 - 24x^2 + 57x - 42$ ~~$x^3\ 8x^2\ 19x\ 14$~~

$+3x^3 - 23x^2 + 34x \;\; -x + 1$

$-x^2 + 23x - 42$

$-3x^2 + 69x - 126$

$-3x^2 + 23x - 34$

$46x - 92$

$x - 2$

$-3x^2 + 23x - 34 \;\; (x - 2$

$-3x^2 + 6x \;\; -3x + 17$

$17x - 34$

$17x - 34$

0

$17 - 3x$

$x - 2$

To find the Wt and cost of a conductor of ~~Cu~~ pure Cu, having one Ohm resistance

Length ranging in 20 feet to 3000 ft. ~~[illegible]~~ from 100 ft.

Law the ~~cost~~ wt will increase as the square of the distance

∴ Find the wt and cost for 20 ft call that unity multiply by 4, 9, 16, 25 36, &c

A Cu wire 1 ft. long weighing one grain after Jenkin p 249 has a resistance of.

.2064 Ohms.

A Cu wire 1 ft. long having a resistance of 1 Ohm will weigh .2064 grains

$$\text{or } \frac{.2064}{7000} \text{ lbs.}$$

A Cu wire 20 ft long having a resistance of 1 Ohm will weigh

$$\frac{400 \times .2069}{7000} \text{ lbs}$$

$$\begin{array}{r} .2064 \\ 4 \\ \hline 70)\overline{.8256} \\ .01179 \text{ lbs} \end{array}$$

175 $\quad$ 2.2430
comp 144 $\quad$ 7.8416 −10
log 5760 $\quad$ 3.7604
13.8450
7000 $\quad$ 3.8450

7000 grains in lb. Adv.

60° Fahr = 15.5° C
32
28
5
9)140
15.55

Increase of resistance

1°C $\quad$ .003824
15.55
$\bar{3}.5827$
1.1923
$\bar{2}.7850$
.061

.001177 $\quad$ $\bar{3}.0700$
1.061 $\quad$ .0258
$\bar{3}.0958$

.0124 lbs at 60° Farh

a Cu annealed wire 1 foot long .001 ins. in diameter has resistance of 9.718 Ohms

a Cu wire 1 foot long ~~.001 in~~ having 1 Ohm resistance will have a diameter of $\frac{\sqrt{9.718}}{1000}$ inches

When 20 feet long

$\frac{\sqrt{20}\,\sqrt{9.718}}{1000}$ inches

$\sqrt{20}$ 1.3010

.6505

$\sqrt{9.718}$ .9876

.4938

.6505

.4938

$\bar{2}$

.0139 $\bar{2}.1443$

20 feet long wire 1 ohm

diameter .0139 inches

[illegible] °C

at [illegible] 65° Fahr

~~[illegible]~~ ~~$\bar{2}.1800$~~

~~$\bar{1}.3423$~~

$\sqrt{1.061}$ .0258

.0129

$\bar{2}.1443$

.0143 inches $\bar{2}.1572$

Sprague

1 ohm of wire .001 inch in diameter has a length of .09674 feet

---

1 foot of wire having a resistance of 1 ohm will have a diameter

$\left(\frac{1}{.09674}\right)^{\frac{1}{2}} \frac{1}{1000}$ in.

11.0146 of

5.5073 .00321 in.

$\bar{3}.5073$

$\sqrt{20}$ .6505

$\bar{2}.1578$

20 feet with resistance of 1 ohm

D = .0143

$\bar{2}.1576$ log Diameter

[illegible]

A foot of wire .001 in in diameter weighs .0[illegible] grains

1 Ohm of Cu wire .001 in in diameter weighs $\frac{1}{3,417,000}$ lbs

As a wire 20 feet long having an 1 ohm resistance has a diameter of .0143 inches it will weigh $\frac{14.3}{3,417,000}$

1.1575
1.1575
3.4664 - 10
5.7814
$\bar{5}$.7814
20 1.3010
$\bar{3}$.0824

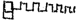
20 feet

.001204

Sprague .001254 lbs
Jenkin .00124

$\bar{2}$.1576 Conductor 1 ohm
2 .3010 20 feet long has
$\bar{3}$.8566 Cross Section of
$\bar{3}$.8560
.4971
$\bar{4}$.2103 .000162

This to be multiplied by 2 for conductor of 40 feet and so on.



40 feet
2 multiply

$\sqrt{2}$

$.0143$
1.41 Diam

$.000162$ sq in
$2.$

~~.0~~00125 ~~#~~
$4.$ lbs

product by price of ..
.25 cts

60
3 $\sqrt{3} = 1.73$
$3^2 = 9.$

80 4 $\sqrt{4} = 2$
$4^2 = 16.$

100 $\sqrt{5} = 2.23$
5
$5^2 = 25.$

120 $\sqrt{6} = 2.44$
6
$6^2 = 36.$

140 $\sqrt{7} = 2.64$
7
$7^2 = 49$

160 $\sqrt{8} = 2.82$
8
$8^2 = 64$

180 9 $\sqrt{9} = 3$
$9^2 = 81$

200 10 $\sqrt{10} = 3.16$
$10^2 = 100$

$.0143$
$.00725$

~~$\bar{3}.18603$~~
$\bar{3}.18603$
$.4971$
$\bar{4}2177$

165

Lenghts

20
40
60
80
100
120
140
160
180
200
250
300
350
400
450
500
550
600
650 660 1/8 mile
700
800
900
950
1000
1100
1200
1300 1320 1/4 mile
1400
1500
1600
1700 1760 1/3 mile
1800
1900
2000

2200
2400
2600 2640 1/2 mile
2800
3000
3250
3500
3750
4000
4500
5000
5280 1 mile

4)5280
1320

3)5280
1760

2)5280
2640

~~1~~ 6046.5 feet of 1/4 in wire ~~Line~~ has
1 Ohm resistance

2) 6046.5
302.325 times 20

.0143
$\bar{2}.1553$
2.4404
1.4402

.248 in $\bar{1}.3955$
in diameter

6046.5
lb. per ft. 5.29
1140 lbs
$285 cost

3.7816
.7235
3.0581

.01208
3.7816
3.7816
$\bar{2}.0820$
5.6452
20
1.3010
4.3442

~~3.7816~~
~~3.7816~~
4.3442
1.3010
3.0432

~~110.5~~ lbs
1105 lbs

comp 1550 $\quad \bar{3}.8097$

.20 $\quad 1\ 3010$

$\bar{1}.1107$

10129

.00642

---

a wire 21.5 feet long weighs $21.5 \times \frac{1}{1488.1}$ lbs. and it has a resistance of 1 Ohm. How much will a wire 20 feet long having a resistance of 1 Ohm weigh

$$\frac{1}{\left(\frac{21.5}{20}\right)^2}\left(21.5 \times \frac{1}{1488.1}\right)$$

$$\frac{20^2}{21.5^2}\left(21.5 \times \frac{1}{1488.1}\right)$$

$$\frac{20^2}{21.5}\left(21.5 \times \frac{1}{1488.1}\right)$$

1.3010

1.3010

8.[illegible] −10

6.8272 −10

10.0970

$\bar{2}.0970$

.0125

A wire one foot long weighing 1 grain has a resistance of

.2064 Ohms

∴ a wire 1 foot long having a resistance of 1 Ohm will weigh

.2064 grains

$= \frac{.2064}{7000}$ lbs

a wire 20 feet long ~~will weigh~~ having a resistance of 1 Ohm will weigh

$\frac{20^2 \times .2064}{7000}$

$= \frac{400 \times .2064}{7000}$

4 | 70
3

.2064
4
.70) .8256
.01179

13

55
5
27
110
4
13
115
1
11
170
70
700
.4480

E
B

132 per 100

1 wire 20 feet long ~~weighs~~ having a resistance of 1 Ohm at 0°C weighs .01179 lbs

a wire .09674 feet long having a resistance of 1 Ohm weighs $\frac{1}{3.417000}$ lbs.

what will a wire 20 feet long having a resistance of an Ohm weigh

$\frac{20^2}{.09674^2} \quad \frac{1}{3.417.000}$ lbs

20
20

1.3010
1.3010
11.0144 -10
3.4662 -10
7.0826
11.0144
18.0970

$\bar{2}$.0970 .0125

a wire 20 feet long ~~weighing~~ having a resistance of 1 Ohm weighs .0125 lbs

~~20) 1500~~
~~75~~

~~.0125~~
~~75~~
~~625~~
~~875~~
~~.9375~~

2000 feet 100 times

()

.()

()^2

.143 m = D

.0162 D m = CS

125 lbs

$31.25 cost

m

2020

~~3.3054~~
~~1.6527~~
~~6.6108~~

101 times

2

144

~~3.3054~~
~~1.5149~~

~~1.6527~~
~~1.8080~~

~~6.6108~~
~~4.7077~~

.143 1.0021
1.1574

.0163
.~~0164~~ 2.0043
2 2138

127 4.0086
2.1055

2040
102 times

.145 1.0043
1.1596

.0165
.~~01605~~ 2.0086
2 2181

4 | 130.2
32.55

4.0172
2.1141

103

.146 1.0064
1.1617

2.0128
2 2223

.0166

4.0256
2.1225

132.
34.

J.L

104

.146

1.0085

$\bar{1}.1638$

.0168

2.0170

$\bar{2}.2265$

135.2

$33.8

4.0340

2.1309

105

.148

1.0106

$\bar{1}.1659$

.0170

2.0212

$\bar{2}.2307$

137.8

$34.45

4.0424

2.1393

106

.147

1.0126

$\bar{1}.1679$

.0172

2.0253

$\bar{2}.2348$

140.4

35.1

4.0506

$\bar{2}.1475$

107

.148

1.0147

$\bar{1}.1700$

.0173

2.0294

$\bar{2}.2389$

143.2

35.8

4.0588

2.1557

108

.1486 $\frac{1.0167}{\bar{1}.1720}$

.01754 $\frac{2.0334}{\bar{2}.2439}$

1.45.6 $\frac{4.0668}{2.1637}$
36.40

109

.1493 $\frac{1.0187}{\bar{1}.1740}$

.01766 $\frac{2.0374}{\bar{2}.2469}$

148.5 $\frac{4.0748}{2.1717}$
37.12

110

.1502 $\frac{1.0207}{\bar{1}.1760}$

.01782 $\frac{2.0414}{\bar{2}.2504}$

151.2 $\frac{4.0828}{2.1797}$
37.80

111

.1506 $\frac{1.0226}{\bar{1}.1779}$

.01798 $\frac{2.0453}{\bar{2}.2548}$

$\frac{4.0906}{2.1876}$

154.0
38.50

17 112

.1513 1,0246
$\bar{1}$1798

2.0492
.0181 $\bar{2}$.2587

4.0984
1565 2.1953
39.20

113

1.0265
.152 $\bar{1}$1818

2.0531
.0183 $\bar{2}$2626

4.1062
1595 2.2031
39.62

114

1,0284
.1526 $\bar{1}$1837

2.0569
.0184 $\bar{2}$.2654

4.1138
162.3 2.2107
40.57

115

1.0303
.1533 $\bar{1}$1856

2.0607
.0286 $\bar{2}$.2702

4.1214
1653 2.2183
41.32

116

.154 $\frac{1.0322}{\bar{1}.1875}$

.01879 $\frac{2{,}0645}{\bar{2}.2746}$

168.
42. $\frac{4{,}1290}{2.2259}$

117

.1546 $\frac{1.0341}{\bar{1}.1892}$

.01896 $\frac{2.0682}{\bar{2}.2777}$

171.2
42.80 $\frac{4.1364}{2.2333}$

118

.155 $\frac{1.0359}{\bar{1}.1912}$

.01913 $\frac{2.0719}{\bar{2}.2814}$

174.1
43.52 $\frac{4.1438}{2.2407}$

119

.1559 $\frac{1.0377}{\bar{1}.1930}$

.01928 $\frac{2.0755}{\bar{2}.2850}$

176.9
44.22 $\frac{4.1510}{2.2479}$

120
20
2400

.1567 $\frac{1.0396}{\bar{1}.1949}$ Diam.

.1945 $\frac{2.0792}{\bar{2}.2887}$ Cross sec

180.
45. $\frac{4.1584}{2.2553}$ Weight

121

.1573 $\frac{1.0414}{\bar{1}.1967}$

.0196 $\frac{2.0828}{\bar{2}.2923}$

183
45.75 $\frac{4.1656}{2.2625}$

122

.1579 $\frac{1.0432}{\bar{1}.1985}$

.01975 $\frac{2.0864}{\bar{2}.2959}$

186.1
46.52 $\frac{4.1728}{2.2697}$

123.

.1585 $\frac{1.0449}{\bar{1}.2002}$

.01995 $\frac{2.0899}{\bar{2}.2994}$

189.2
47.40 $\frac{4.1798}{2.2767}$

124

.1593 $\frac{1.0467}{\bar{1}.2020}$

.02008 $\frac{2.0934}{\bar{2}.3029}$

192.2 $\frac{4.1868}{\bar{2}.2837}$

48.05

125

.1597 $\frac{1.0484}{\bar{1}.2037}$

.02025 $\frac{2.0969}{\bar{2}.3064}$

195.3 $\frac{4.1938}{2.2907}$

48.82

126

.1605 $\frac{1.0502}{\bar{1}.2055}$

.02042 $\frac{2.1004}{\bar{2}.3099}$

198.5 $\frac{4.2008}{2.2977}$

49.62

127

.1615 $\frac{1.0529}{\bar{1}.2082}$

.02058 $\frac{2.1038}{\bar{2}.3133}$

201.5 $\frac{4.2076}{2.3045}$

50.37

128

.1615 $\frac{1,0536}{\bar{1}\,2089}$

.02573 $\frac{2,1072}{\bar{2},3167}$

2048 $\frac{4,2144}{2,3113}$
51.20

129

.1622 $\frac{1,0553}{\bar{1}.2106}$

.0209 $\frac{2.1106}{\bar{2}\,3201}$

209. $\frac{4.2212}{2,3181}$
52.

130

.163 $\frac{1,0569}{\bar{1},2122}$

.2105 $\frac{2.1139}{\bar{2}.3234}$

211.1 $\frac{4,2278}{2.3247}$
52.77

131

.1635 $\frac{1,0586}{\bar{1},2139}$

.02122 $\frac{2.1173}{\bar{2}\,3268}$

215.1 $\frac{4.2356}{2.3325}$
53.25

132

.1643 $\frac{1{,}0603}{\bar{1}\cdot 2156}$

.02138 $\frac{2.1206}{\bar{2}\cdot 3301}$

217.8 $\frac{4.2412}{2\cdot 3381}$

54.45

133

.1649 $\frac{1{,}0619}{\bar{1}\cdot 2172}$

.02155 $\frac{2.1239}{\bar{2}\cdot 3334}$

221.2 $\frac{4.2478}{2\cdot 3447}$

55.30

134

.1655 $\frac{1{,}0635}{\bar{1}\cdot 2188}$

.02171 $\frac{2.1271}{\bar{2}\cdot 3366}$

224.5 $\frac{4{,}2542}{2.3511}$

56.12

135

.166 $\frac{1{,}0651}{\bar{1}\cdot 2204}$

.02187 $\frac{2.1303}{\bar{2}\cdot 3398}$

227.8 $\frac{4.2606}{2.3575}$

56.95

136

1,0667

.1667 $\bar{1}$·2220

2·1335

.02203 $\bar{2}$ 3430

4.2670

231.2 2·3639

57.80

137

1.0683

·1673 $\bar{1}$ 2236

2·1367

.0222 $\bar{2}$.3462

4·2734

234.6 $\bar{2}$3703

58.65

138

1,0699

.168 $\bar{1}$ 2252

2.1399

.02236 $\bar{2}$ 3494

4.2798

238.1 2.3767

59.52

139

1.0715

.1686 $\bar{1}$.2268

2·1430

.02252 $\bar{2}$ 3525

4.2860

241.5 2.3829

60.37

140

$.1691 \quad \frac{1.07.30}{\bar{1}\ 2283}$

$.02268 \quad \frac{2.1461}{\bar{2}\ 3556}$

$245. \quad \frac{4.2922}{2.3891}$

61.25

141

$.1698 \quad \frac{1.0746}{\bar{1}\ 2299}$

$.02284 \quad \frac{2.1492}{\bar{2}\ 3587}$

$248.5 \quad \frac{4.298}{2.3953}$

62.12

142

$.1704 \quad \frac{1.0761}{\bar{1}\ 2314}$

$.02301 \quad \frac{2.1523}{\bar{2}.3618}$

$252.1 \quad \frac{4.3046}{2.4015}$

63.02

143

$.171 \quad \frac{1.0776}{\bar{1}\ 2329}$

$.02316 \quad \frac{2.1553}{\bar{2}.3648}$

$255.6 \quad \frac{4.3106}{2.4075}$

63.90

144

.1716 — $\frac{1.0792}{\bar{1}.2345}$

.02333 — $\frac{2.1584}{\bar{2}.3679}$

259.2 — $\frac{4.3168}{2.4137}$

64.80

145

.1722 — $\frac{1.0807}{\bar{1}.2360}$

.0235 — $\frac{2.1614}{\bar{2}.3709}$

262.9 — $\frac{4.3228}{2.4197}$

65.72

146

.1728 — $\frac{1.0822}{\bar{1}.2375}$

.02365 — $\frac{2.1644}{\bar{2}.3739}$

266.5 — $\frac{4.3288}{2.4257}$

66.62

147

.1734 — $\frac{1.0836}{\bar{1}.2389}$

.02382 — $\frac{2.1673}{\bar{2}.3768}$

270.1 — $\frac{4.3346}{2.4315}$

67.52

148

.1740 $\frac{1.0851}{\bar{2}2404}$

.02397 $\frac{2.1703}{\bar{2}.3798}$

273.9
68.47 $\frac{4.3406}{2.4375}$

149

.1744 $\frac{1.0866}{\bar{1}2419}$

.02414 $\frac{2.1732}{\bar{2}3827}$

277.6
69.40 $\frac{4.3464}{2.4433}$

$\frac{150 \quad .20}{3000}$

$\bar{1}.2433$
$\underline{.3010}$
$\bar{2}.9423$
$\bar{2}.9423$
$\underline{.4971}$
$\bar{2}.3817$

.175
~~.1764~~ $\frac{1.0880}{\bar{1}2433}$

.0243
.02401 $\frac{2.1761}{\bar{2}3856}$

281.3
70.32 $\frac{4.3522}{2.44[illegible]1}$

151

.1758 $\frac{1.0895}{\bar{1}2448}$

.2446 $\frac{2.1790}{\bar{2}.3885}$

285.
71.25 $\frac{4.3580}{2.4549}$

150.

.1760

1.08804
$\bar{1}$.24564

1789
1752 .02437
537
74

2.17609
$\bar{2}$.38639

5 / 81
162

281.2

4.35218
2.44908

2515
2434
81

300.3
281.2
19.1

19.
3.82
281.2

151	.1752	.024602	2850
152	.175	.024664	2888
153	.175	.024826	292
154	.1770	.024988	296
155	.1786	.025150	

155

.1789

1.0951
$\bar{1}$.2527

.02515

2.19033
$\bar{2}$.4006

300.3

4.3806
2.4775

1818
1789
29
6

2597
2515
82
16

320
300.3
19.7
39

155	.1789	2515	300.3
156	.1795	2531	304.2
157	.1801	2547	308.1
158	.1807	2563	312.1
159	.1813	2580	316.0
160	.1818	2597	320

60 160

.1818 $\frac{1.1020}{\bar{1}.2596}$

.02597 $\frac{2.2041}{\bar{2}.4144}$

320. $\frac{4.4082}{2.5051}$

1846 − 1818 = 28; 28 ÷ 5 = 5.6

2674 − 2597 = 77; 15.2

3419 − 320 = 21.9; 4.4

160	1818	2597	320
	1823	2612	3244
162	1829	2628	3288
163	1835	2643	3332
164	1841	2658	3376
165	1846	2674	341.9

165 61

.1846. $\frac{1.1087}{\bar{1}.2663}$

.02674 $\frac{2.2175}{\bar{2}.4278}$

341.9 $\frac{4.4370}{2.5339}$

1874 − 1846 = 28; 28 ÷ 5 = 5.6

2759 − 2674 = 85; 85 ÷ 5 = 17

361.2 − 3419 = 19.3; 386

165	1846	2674	3419
166	1852	2691	3457
167	1857	2708	3496
168	1863	2725	3535
169	1868	2742	3573
170	1874	2759	3612

170

187.4 $\quad \frac{1.1152}{\bar{1}.2728}$

.02759 $\quad \frac{2.2304}{\bar{2}.4407}$

361.2 $\quad \frac{4.4608}{2.5577}$

$\frac{1902}{1874}$ 28 5.6

$\frac{284}{2759}$ 81 16.2

$\frac{382.8}{361.2}$ 21.6 4.32

170	1874	2759	361.2
171	1879	2775	3655
172	1885	2792	3697
173	1890	2808	3740
174	1896	2824	3783
175	1902	284	3828

( )

175
20
3500

190.2 $\quad \frac{1.1215}{\bar{1}.2791}$

.0284 $\quad \frac{2.2430}{\bar{2}.4533}$

382.8 $\quad \frac{4.4860}{2.5829}$

$\frac{1928}{1902}$ 26 52

$\frac{2922}{284}$ 82

$\frac{405.1}{382.8}$ 22.3 4.46

Length	Diameter	Cross Section	Weight, Cost
3500	(75) 1902	.0284	~~[illegible]~~
3520	(76) 1907	.0285	387.26
3540	(77) 1912	.02872	391.72
3560	(78) 1917	.02888	396.18
3580	(79) 1922	.02904	400.64

84 180

.1928 — 1.1276 / $\bar{1}.2852$

.02922 — 2.2553 / $\bar{2}.4655$

405.1 — 4.5106 / 2.6070

1955	3004	427.9
1928	2922	405.1
27	82	5)22.8
		4.56

D		weight
80 .1928	.02922	405.1
81 .1933	.02938	409.66
82 .1938	.02954	414.22
83 .1944	.02970 ~~.02980~~	418.78
84 .1949	.02986	423.34

3002

185

.1955 — 1.1336 / $\bar{1}.2912$

.03004 — 2.2672 / $\bar{2}.4775$

427.9 — 2.5344 / .6313

1983	3084	4514
.1955	3004	427.9
28	80	5)23.5
		4.70

D		weight
85 .1955	.03004	427.94
86 .1960	.03020	432.64
87 .1966	03036	437.34
88 .1971	03052	442.0
89 .1977	03068	446.7

8p 190

.1983

$\frac{1.1394}{\bar{1}.2970}$

.03084

$\frac{2.2788}{\bar{2}.4891}$

$\frac{4.5576}{2.6545}$

451.4

2007
1983
24

3165
3084
81

4754
451.4
5)24.0
4.8

.0048

(90)	.1983	.03084	
(91)	.19878	.0310	451.4
(92)	.199	.03116	456.2
		3132	
(93)	.19974	3148	461.0
(94)	.20022		465.8
(95)	.20070		470.6

1.95

.2007

$\frac{1.1450}{\bar{1}.3026}$

.03165

$\frac{2.2900}{\bar{2}.5003}$

$\frac{4.5800}{2.6749}$

475.4

2033
2007
26
.0005

3165
3054
5)81

5000
4754
5)246
4.92

.2007	.03165	475.4
.20122	3181	480.32
.20174	3197	485.24
.20226	3213	490.16
.20278	3229	495.08
.30330		

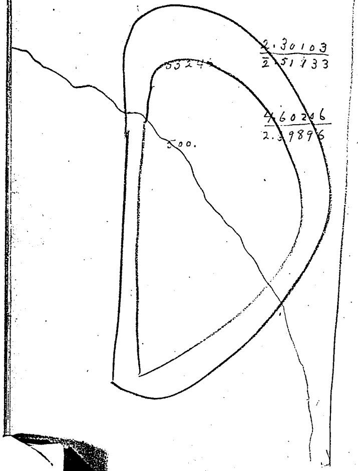
88 200

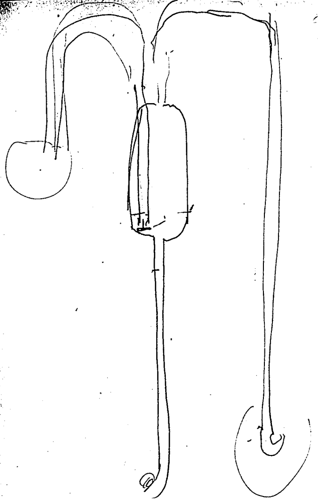
·2033

$\frac{1.15051}{\bar{1}.30811}$

$\frac{2.30103}{\bar{2}.51133}$

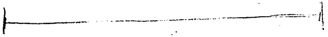
$\frac{4.60206}{2.39896}$





~~No. 1~~

Straight wire 1/4 mile long 1000 lamps every 25 feet 10 lamps in house



100 Houses

4)5280
1320
2640

25)1320

1320
.13.
26

1/4 mile

House on each side every 25 feet

That is 20 lamps each 25 feet 2 conductors of 1 Ohm each length

1	50 feet	100	17	450	32	850	
2	75	150	18	475	33	875	
3	100	200			34	900	
4	125	250	19	500	35	925	
5	150	300	20	525	36	950	
6	175	350	21	550	37	[illegible]	
7	200	400	22	575	38	[illegible]	
8	225		23	600			
9	250		24	625			
10	275		25	650			
11	300		26	675			
12	325		27	700			1250
				725			1275
13	350		28	750		50	1350
14	375		29	775			
15	400		30	800			
16	425		31	825			

I obtained the point where the sum of all below equalled the above

feet away	feet wire	lbs wire
50	100	.31
75	150	.71
100	200	1. 25
125	250	1 .95
150	300	2.81
175	350	3.92
200	400	5.00
225	450	6.40
250	500	7.81
275	550	9.40
300	600	11.25
325	650	13.3
350	700	15.31
375	750	17.55
400	800	20.
425	850	22.6
450	900	25.31
475	950	27.25
500	1000	31.25
525	1050	34.55
550	1100	37.81
575	1150	41.20
600	1200	45
625	1250	48.8
650	1300	52.8
675	1350	56.9
700	1400	61.2
725	1450	65.7
750	1500	70.3
775	1550	75
800	1600	80
825	1650	85
850	1700	90.3
875	1750	95.7
900	1800	101.2
925	1850	
		1264.84

35
14

35
2
70

126484
2
70) 248.0.08
35.43

126
1264.84

1264.

2289
1264
3553

2x) 5280
264
50
21.4 feet

$888.

2) 6878
3439

1000 lamp

70%

$ 888

$ 1719.

$179 per lamp

$ 900

Feet away	feet of wire	lbs of wire
925	1850	106.9
950	1900	112.8
975	1950	118.8
1000	2000	125.
1025	2050	131.1.
1050	2100	137.8.
1075	2150	144.4.
1100	2200	151.2
1125	2250	157.1
1150	2300	165.3
1175	2350	173.
1200	2400	180
1225	2450	187.5
1250	2500	195.3
1275	2550	203.1
1300	2600	211.1
1325	2650	219.6

50

2630.0

22893

~~2630~~
~~21993~~
~~43965~~

Portland

211.1
219.6
4307

1500

1500

2480
1197.40

~~$7.35 per house~~

$17.19 per house

~~6876~~

~~12196~~

2480
4398.6
4) 6878.6
1719.6

1264,86
2289.3
1)3554 14

50 houses

on one quarter of a mile each with ten lamps require 3554. lbs of Cu so that each will have one Ohm between ~~an~~ it and the central station The houses beginning at 50 feet from central station and being 25 feet apart up to 1275 feet

4)5280
1320 feet in 1/4 mile

in one hundred houses

3554.14
2
710 228

71. lbs to a house

or as if the average house was 750 feet away

Cost per ~~house~~. average of 100 Cu 25 cts per lb

4)71

$17.75

1.77 per lamp

---

interest yearly

17.7 cts per lamp

10.5 Webers

~~for Cooking stoves~~

15 candle power from lamps having about .65 Ohm resistance

100 Ohm lamp ?

$\frac{100}{.65}$ ~~times~~ Times R'

$\frac{.65}{100}$ / 10.5 Webers on 100 Ohm lamps to give the same effect

~~[illegible]~~

$\sqrt{.0065} = .08$ Webers

10.5
.08
.840 Webers

$\frac{1}{20}$ ~~Webers~~ Volt

.05 1

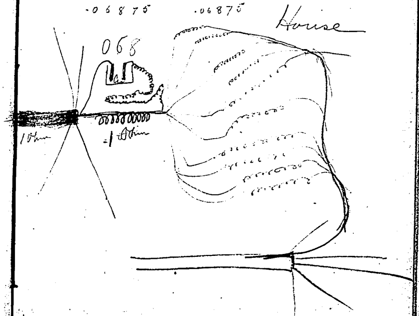
.06875 Volts on 1 Ohm

.06875 Volts

.12

.06875

.06875 .06875



.0678

.0678

.06 . 8

Where is the point point

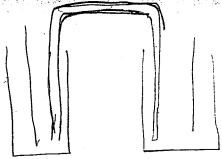
What do you mean?

What do you know? Nothing.

What nothing? Yes nothing!

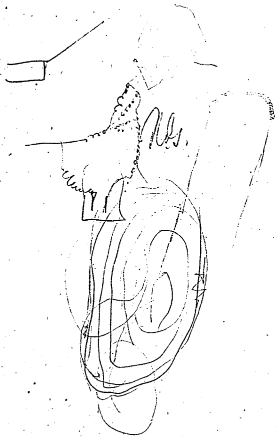
~~[illegible]~~ Daniells polarization
30

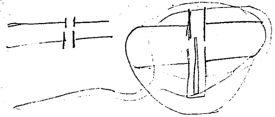
~~No.~~ 1 lamps say	.001 Grain	
~~No.~~ 2 lamps	.031	
~~No.~~ 3 lamps	.061	
~~No.~~ 4 lamps	.091	
~~No.~~ 5 lamps	.121	
~~No.~~ 6 lamps	.151	
~~No.~~ 7 lamps	.181	
8 lamps	.211	
9 lamps	.241	
10 lamps	.271	

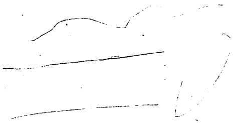


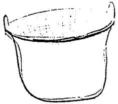
H_2SO_4

faults with this the acid will tend ~~[illegible]~~ dissolve the Cu. plates Zn ~~on~~ the cu solution acid will be set free









$\lfloor (a+n-1)^2$

1, 2, 3, 4, 5

1, 4, 9 16 25

$$\frac{a^2+(a+1)^2+(a+2)^2 \ldots +3)^2+(a+4)^2}{5}$$

$a^2+(a^2+2a+1)(a^2+4a+4)(a^2+6a+9$

$na^2+2(1+2+3+4+5+(n-1)a)=$

$1^2+2^2+3^2+4^2+5^2+6^2+7^2$

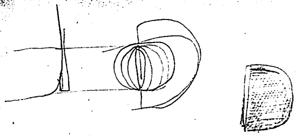
~~$1+2^2+3^2+4^2+5^2+6^2+7^2+8^2$~~

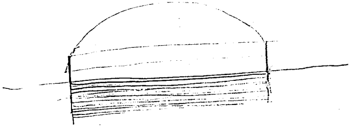
~~$1+2^2+3^2+4^2$~~

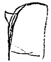
$$\frac{1+2^2+3^2+\ldots+n^2}{n}$$

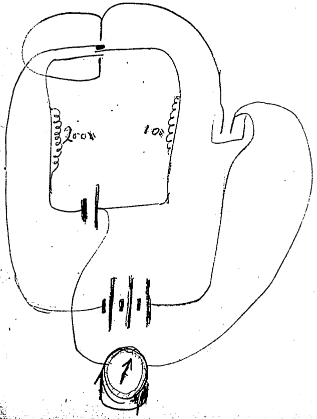
$$\frac{1+2^2+3^2+\ldots+n^2}{n}$$

$$\frac{1+2^2+3^2+\ldots+n^2}{n}$$








2000ω
10ω

$C = \frac{\mathcal{E}}{R}$

$C^2 R$

$R = a r$

$r = \frac{R}{a}$

$C^2 \frac{R}{a} = $ Energy

$\frac{C^2}{a}$

Question If a lamp have a resistance of R Ohms and a current of C webers How great a current must be put through a lamp having $\frac{R}{a}$ Ohms to give the same light

$$C^2 R = C_x^2 \frac{R}{a}$$

$$a C^2 = C_x^2 \qquad C_x = C\sqrt{a}$$

$C = \frac{\mathcal{E}}{R}$

1 Ohm c

$\mathcal{E} = 100$ volts

10 Ohms total

10 lamps

1 Ohm lamp

Current = 10 Webers

$E \times 1 = 100$ Energy

100 Ohm Lamps

Current = 1 Weber

100 = Energy

~~[illegible]~~

$$C^2 R = C_x^2 R a_1$$

$$C_x = C^2 \sqrt{\frac{1}{a_1}}$$

$8\frac{1}{2}$

$25\frac{1}{2}$

150

60 inches

10 Lamps 1 ohm

100,

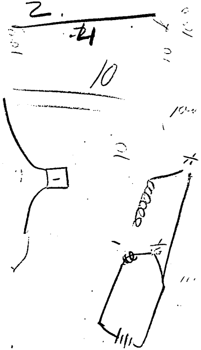
1000,

650,

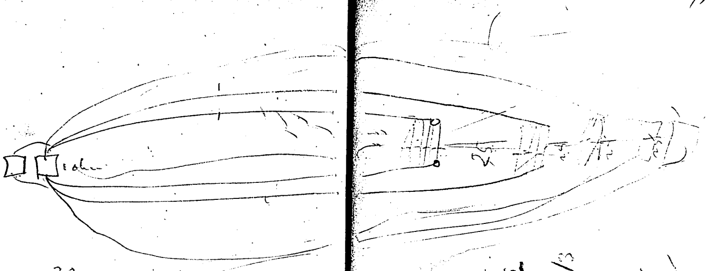
666.

650. Res. 10 series.

or 10 $\frac{150}{a.}$ Lamps Mul Arc,



5 Webers



4 30,

30, 25

60 60 60 40.

60

60

60

1	25
2	12 $\frac{1}{2}$
8	6 $\frac{1}{4}$
16	3 $\frac{1}{8}$

1	100
2	50
4	25
8	12 $\frac{1}{2}$
16	6 $\frac{1}{4}$
32	

11 5 $\frac{1}{12}$ 3 $\frac{2}{3}$

50 ft

10 lamps 150 yards
6
3050

120.

6 nights for 12 dollar

27. 36

27.
36
63
18
81.

4 1/2 c per day
net on 10 Lamps

Loss† in Conversion, 10 pc

Loss in machine — 25.
" Conductors 10
Station Connections
Safety magnets at station
Commutators
[illegible]

50, Lamp engineer 3
Meter Shunt,

4 3 1/2 3.5
150
20. 20. 20 20

17. 6 150.

100. 10 per year

200 1 1/2 3 int on 20 lamps per night
1/2 3/4 on conversion,
1 1/2 6 power.
3/4 1 1/2.

12. 4 1/2 c per day

10.000.

50 2
25 4
12 8
6 16
3 190 32
1 500000 64
75½ 128
325 256
162 512
81 1.024

1,800 000

20)397(19¾
20
197
180
17

20)367(18
20
167
160
7

20 lights

100 — Mac.
45 Lamps
~~15~~ 3 Connection Station
8 Belts,
10 Overshafting
87 Horsepower plant
87 Boiler plant
5 Meters,
40 Conductors
10 Extra paint.
397
30
3 367

100 000
100
10,000,000

81.000
20
1,620,000

81000

7.03

25

7

5)1.75(35

5

27

25

2

35

5

175

32

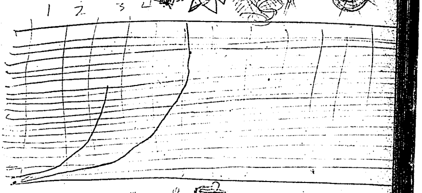
25

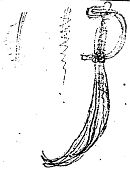
160

64 0

5)50

160





77

25

385

154

5)1923

3,85

1548

77

25

385

150

)1873

225
25
1125
450
5625
5)5625
5125
500

56.25

65
25
325
130
1625

65 8
5
325

~~65~~

1670
5
8350

108
5
540

5

104
5
520

8' 160
6

20 / 12000 (600
120
0

6000.

50
20
1000.

600
20
12,000

5.

166
6
996

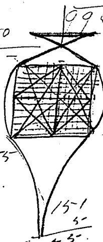
600,

6) 1000
166
6

166
6
1

600
1000 996.
600,000
1

3001



755

187
5
935.

9

15-1
5
755.

ohm

1 - 1/2 . 5

6 $\frac{1}{2}$ ohm

18 5

18 5 8 9

m

15 $\frac{1}{2}$ 7 78

15 7 75

16 . 8 . 80

15 7 78

103

1700000

$ 176000.

1760000000

1st

1 1 10

8.3 8.3 83.

2nd 1 $\frac{1}{2}$ 5

15.4 7.7 77

23 $\frac{15}{6}$ ½ per candle

17.

14 77

C^2R

$C = \frac{E}{R}$

7
15
99

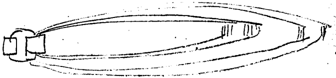
$\frac{E^2}{R}$

1	99
2	97
4	94
8	88
16	80
20	77

23

20

½



½

1 1 ½ ¼

10 20 40 8

10 5 2½

½ 1 ½

.10 5

A magnet 1 Ohm

E = 10 Volts

10 Webers

~~The~~ Strength 10.

Cost 100

The same sized wire is wound round again so as to have 2 Ohms resistance

5 Webers of current on 2 Ohms give 10 Strength

if there is no weakening from carrying the wire further from core

Cost 5 × 5 × 2 = 50

---

4 Ohms

2.5 Weber

strength = 2.5 × 4 = 10

cost
2.5
6.25
4
25.0 = Cost

---

8 Ohms

1.25 × 8 = 10 Strength

1.25
1.56
8
1248 12,50 = cost

$R \times C$ = Strength

$C^2 R = \frac{E}{R}$ Cost

$C = \frac{E}{R}$

---

16 Ohms.

Strength $.625 \times 16 = 10$

Cost 6.25

and so on the strength of the field being the same while the cost is lessened in proportion as the resistance is increased. ~~The~~

The cost of the machine is increased by the

amount of wire. And as the efficacy of the wire diminishes, ~~as~~ when it is removed from the core a point is reached where there is no gain. This point to be found by experiment.

Thermo piles may be used with magnets under this condition. They give ~~the~~ constant E.M.F. which is ~~what~~ is required and may be used thus ~~[illegible]~~ on a resistance which makes the resistance of the Thermo less

less in comparison.

Of course if a Thermo of low resistance could be made it would be the best as the Current costs very little from Thermos, yet a high resistance can be run from them to great ad- ~~to~~ vantage the cost being the wire around the magnets.

Magnets ½ Ohm

2 strength ~~of current~~

196
5
980

185
5
925

1714
5
8570

1486
5
7430

100
1
1

50 : 1

100 ohm Lamp

1 Ohm Machine
1 Ohm Conductor

100
2
102) 100

1

comp 102 $\overset{2}{7}.9914$ comp 101 $\overset{2}{7}.9957$
log 100 2. 2.
$\overline{1}.9914$ 99. $\overline{1}.9957$
98.

2

comp 52 $\overset{2}{8}.2840$ comp 51 $\overset{2}{8}.2924$
log 50 1.6990 1.6990
$\overline{1}.9830$ $\overline{1}.9914$
96.1 98.

~~com~~ 33.3
2

3

Comp 35.3 $\overset{2}{8}.4522$ comp 34.3 $\overset{2}{8}.4647$
log 33.3 1.5224 1.5224
1.9746 97.1 1.9871
94.3 9492
89

4

35
2
comp 27 $\overset{2}{8}.5638$ comp 26 $\overset{2}{8}.5800$
log 25 1.4031 1.4031
1.9669 96.2 1.9831
92.6

5

20
2
Comp 22 $\overset{2}{8}.6576$ comp 21 $\overset{2}{8}.6778$
log 20 1.3010 1.3010
1.9586 95.2 1.9788
90.9

6

1666
~~Co~~ 2 2
comp 18.66 8.7305 Comp 17.66 8.7532
log 16.66 1.2216 1.2216
1.9524 94.3 1.9748
89.5 9042 9496
802 89.

7 14.28 8.7885 15.28 8.8159
2 1.1547 1.1547
Comp 16.28 1.9432 1.9706
Log 14.28 8864 93.4 9.412
87.7 77 87.3

8 12.5 13.5 8.8697
2 1.0969
comp 14.5 8.8387 1.9666
12.5 1.0969 92.6
1.9356
86.2

9 11.111 12.11 8.9169
2 1.0457
comp 13.111 8.8834 1.9626
11.111 1.0457 91.7
1.9291 .9252
84.9 .8582 84.2
72.1

10 .10 11 8.9587
2 1.
comp 12 8.9209
10 1. 1.9587
1.9209 90.9
83.4

11 9.09
2
Comp 11.09 8.9551 10.09 8.9961
9.09 1.9585 1.9585
1.9136 90.1 1.9546
82 8272 9092
672 81.1

12 8.333
2 9.333 9.0309
comp 10.333 8.9859 1.9206
8.333 1.9206 89.3 1.9508
1.9065
80.6 8130
65

13 7.6923
2 8.6923 9.0609
comp 9.6923 9.0135 1.8859
7.69 8859 88.5 1.9468
1.8994 .8936
79.3 .7988 78.3
62.9

14 7.14
.2 8.14 9.0894
comp. 9.14 9.0391 1.8537
7.14 1.8537 1.9431
1.8928 87.7 .8862
78.~~1~~ 7856 76.9
61.

15 6.66

2 2

comp 8.66 9.0625 7.66 9.1158

6.66 1.8234 .8234

76.9 1.8859 86.9 1.9392

16 .7718 .8784

59.1 75.6

17 5.88

2 2

comp 7.88 9.1035 6.88 9.1625

5.88 .7693 .7693

74.6 1.8728 85.4 1.9318

18 5.55

2 2 2

comp 7.55 9.1221 6.55 9.1838

5.55 .7442 .7442

73.5 1.8663 84.7 1.9280

.7326 .8560

54 71.8

16 6.25

2 2 2

comp 8.25 9.0836 7.25 9.1397

6.25 .7958 .7958

75.7 1.8794 86.2 1.9353

87.06

74.2

20

5

2 2 ~~5~~ 2

comp 7. 9.1549 6 9.2219

5. .6989 .6989

1.8538 83.3 1.9208

71.4

25

4

2 2 2

6 9.2219 5 9.

4 .6020 4

66.7 1.8239 80

30

3.333

2 21 2

5.333 9.2731 4.333 9.3633

3.333 .5228 .5228

1.7959 1.8861

62.5 76.9

5918

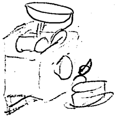
39

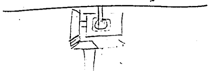
Lamp 100 Ohms

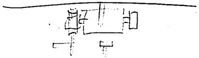
Machine 1 Ohm
Conductor 1/2 Ohms

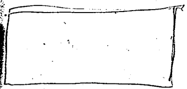
~~2.0~~

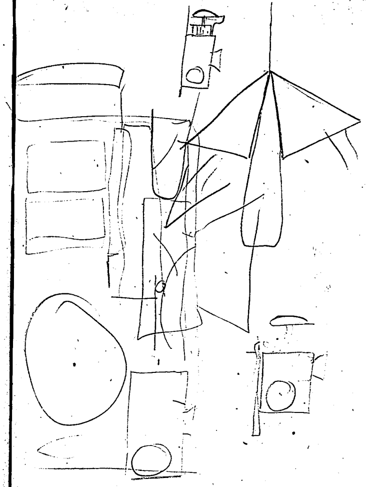
100
1.5
101.5

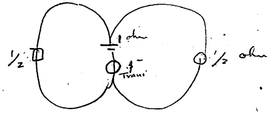


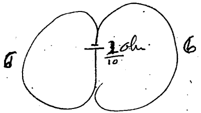









1 ohm
1/2
1/2 ohm
4
Trans


1/10 ohm
G
6

1 - $\frac{2}{5}$

$\frac{1}{8}$. $\frac{1}{15}$ of a Daniel Cell —

on $7\frac{1}{2}$ ohms —

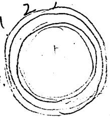
13

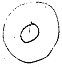
8 ohm total, 3, 4, 5, 6,

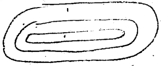
1 1 2

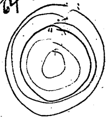
$\frac{1}{8}$ of Vebr.

$\frac{1}{64}$ of a Vsbr.

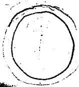


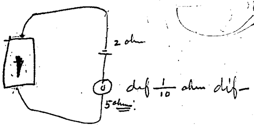






1000



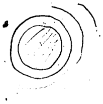

2 ohm
5 ohms
dif $\frac{1}{10}$ ohm dif—

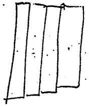
$\frac{1}{5120}$

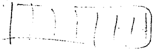
.7. $\frac{1}{70}$.

$\frac{1}{1075}$

$\frac{1}{140}$

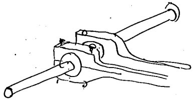


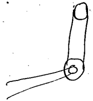


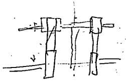


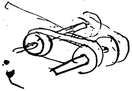
with an induction coil having primary of 1 ohm Carbon button of 5 ohm Callaud Cell 2 ohms total 8 ohms, there will be $\frac{1}{8}$ of a ~~[illegible]~~ Elec on the whole; in the coil there will be $\frac{1}{64}$ of an Elec; as the telephon make $\frac{1}{10}$ of an ohm dif in the ~~[illegible]~~ largest wave, there will be a difference in primary of $\frac{1}{5120}$ of an Elec —

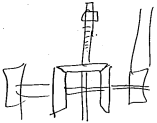
	½ ohm coil.	$\frac{1}{8437}$.	3317. dif
What is,	1 ohm coil	$\frac{1}{5120}$	1475.
	2 " "	$\frac{1}{3645}$	312
	3 " "	$\frac{1}{3333}$	7 = x
	4 " "	$\frac{1}{3326}$	130. x,
	5 " "	$\frac{1}{3456}$	205. x.
	6 " "	$\frac{1}{3661}$	

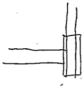


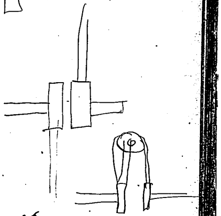


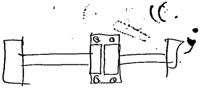


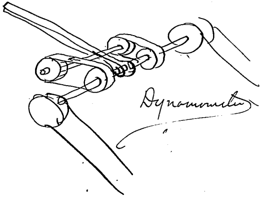


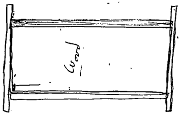









Dynamometer

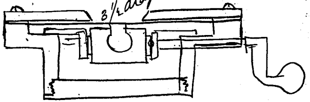


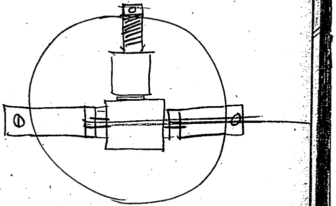
4	layers	23.
6	of	34.
4	"	34.

Edison's telephone

July 1st 1879

Chas Batchelor


3½ diaph plane



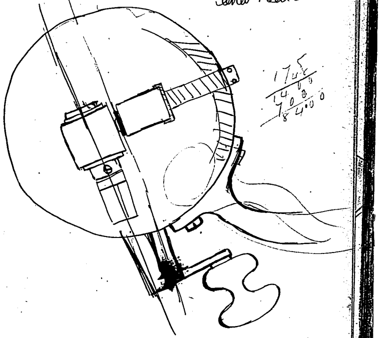
36
2.8 9
29
150
4 7 3
.2 4 2 28
8
8.4.85

36 at 2
50 at 1
50 at

Edison's telephone

July 7 1879

Chas Batchelor



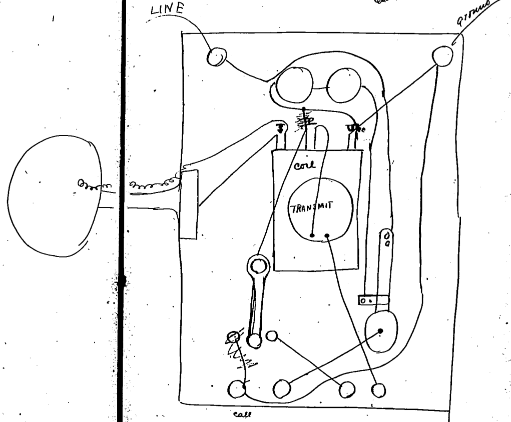
1745
1400
700
8400

Chas Batchelor.

Chas Bat

Edison Telephone

July 4 1879
Chas Batchelor


LINE
ground
coil
TRANSMIT
call

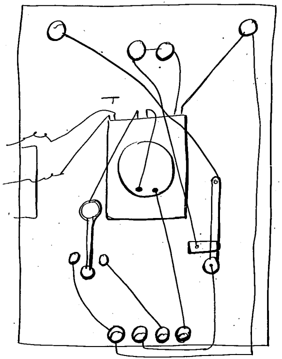
Connections for new design telephone
July 4th 1879
Chas Batchelor

16 carbons — 6¢	96¢
16 Zincs	
Blotting —	8
Glass —	25
Sulphate	
Wooden top	
Brass rod & springs at top	

Edison Telephone

July 7 1879

Chas Batchelor



Connections at back so as not to cross one another

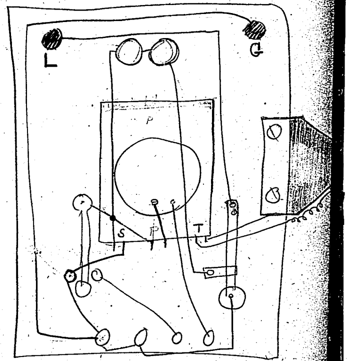
Shaw

Shaw

Drawing

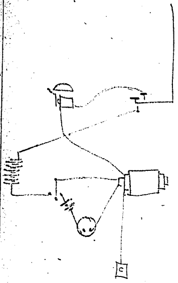
6.0½

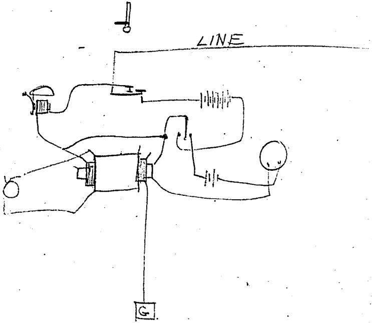
$15—



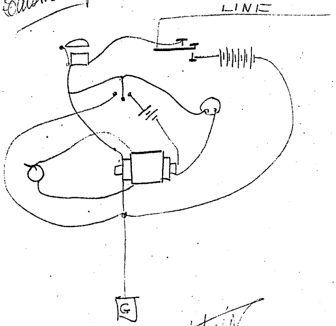
Telephone Connection when arm on right side July 9th 1879

Chas Batchelor

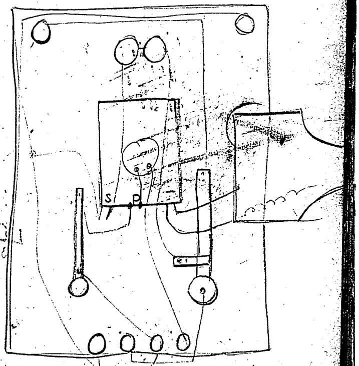

C


LINE
G

Edison telephone July 9th 1879



Chas Batchelor



[illegible] this is the connection for Telephone

$$\frac{278.150}{1823.29} \div \frac{1}{.15} = \frac{273.49}{278.15}$$

610
~~7~~1 0 7
32
9 | 39
4 $\frac{1}{3}$
5
20 $\frac{2}{3}$
1
21 $\frac{2}{3}$ °C

1823.29
.15
911645 .0078248
182329 21
273.49.35 .0038248
0076596
.00804208 6

1.08 77.1 44

278.15) 273.490 (98
250335
2315508
183528
31980

23 4 5
23 4

1 2 1

42.7 42
42.7
2989 42
854
1708
1823.29

42
42
84
168
1764

43 4
6
6 45 4
4 4 3
4

9.83 4
26.2
1966
5898
1966
257.546

257.546 4
1.08
2060368
257546
278.14968

100 : 98
1 .98

Test of the per cent of cu in the wire (given as .042 . cu.

Tested the thousands of D of the Machine wire that was on one

.043
.043
.0425
.04275
.0425
.0425
.04275
.04275
.043
.04275
.0425
.043
.043
.042
.043

Res .15

26.2 ft

1774 ft on the

Temp 71 7 = 21 $\frac{2}{3}$ °C

average D .0427

$$\frac{9.83}{1823.29} \times 26.2 \times 1.08$$

$$\frac{257.546}{1823.29}$$

$$\frac{278.14968}{1823.29} \div \frac{100}{.15} = 98$$

New wire on Reel
marked .042

160 ft ohm

.041
.041
.041
.040.5
.041.5
.041.5
.040.5
.040.5
.040.75
.041.5
.040.75

R. 31
L. 49.5
Temp 78° F
Di 41.

100% Cu

41
41
41
164
1761

$\frac{9.83}{1761} \times 49.5 \times 1.09$

~~$\frac{486.585}{1761} \times 1.09 = \frac{540.38}{1761}$~~

~~$\frac{540.38}{1761} : \frac{1}{31} = \frac{540.38}{54591}$~~

$\frac{9.83}{1681}$

41
41
1681

$\frac{9.83}{1681} \times 49.5 = \frac{486.585}{1681}$

$\frac{486.585}{1681} \times 1.09 = \frac{530.38}{16.81} : \frac{1}{31}$

~~52111) 486.585 (1~~
~~530.38~~
~~52111)~~

$\frac{530.38}{52111}$

52111) 530.380 (10.4
521 11
9 2700

Wire the machine is wound with.

.040.5
.041.
.040.5
41.5
41.5
41.
40.5
41
41.5
41.

R.19
L. 30.8
Temp. 72°

40.5
40.5
2025
1620
1640.25 D²

$$\frac{9.83}{1640.25} \times 30.8 = \frac{302.764}{1640.25} \times 1.08$$

30.8
9.83
924
2464
2772
302.764

302.764
1.08
2422112
302764
328.98512

3 3
5 5 5
4

$$\frac{328.98512}{1640.25} \div \frac{1}{19} = \frac{328.99}{31164.75}$$

1640.25
19
1476225
164025
3116475

31164.75) 328.99(
31164
173500

100%

72
32
9|40

60

88

77
77
5929

85 2
85
425 4
680
7225
44 2
28900
28900
317900.

60)100 (1.6
.25
1.85

4

1.3

1.8) 317900.0 (176611.
18
137
126
119
108
110
108
20
18
20
18
2

18
6
144

18
4
108
126
5

5

176611.

2)317900.
158950

$\frac{.75}{100}$ $\frac{3}{4}$

$\frac{.25}{1.8}$

18
8
144 6

2
7

$\frac{.25}{1.8}$

$\frac{.14}{1.8}$

7

176611. ft in all

4

1

1.8) 176611.0 (109228.
18
166
162
41
36
51
36
150
144
6 16

109228.
.25
546140
218456
27307.00

27.307 ft in each

$$\frac{.14}{1.8}$$

3

$$\begin{array}{r} 109228. \\ .14 \\ \hline 436912 \\ 109228 \\ \hline 15291.92 \end{array}$$

$$\begin{array}{r} 85 \\ 3 \\ \hline 255, \end{array}$$

127

85 } 127
85

85 } 127
85

} 65

} 32½

85
85
85
85

} 65

16

85
85
85
85

} 65

32½

85
85
85
85

} 65

300

$$\begin{array}{r} 100 \\ 100 \\ \hline 10000 \\ 44 \\ \hline 40000 \\ 40000 \\ \hline \end{array}$$

400) 440000 (11
400
400
400
00

$$\begin{array}{r} 11 \\ 400 \\ \hline 4400 \end{array}$$

$$\begin{array}{r} 34 \\ 85 \\ \hline 170 \\ 272 \\ \hline 2890 \end{array}$$

480

$$\begin{array}{r} 60 \\ 3 \\ \hline 180 \end{array}$$

$$\begin{array}{r} 40 \\ 3 \\ \hline 120 \end{array}$$

$$\begin{array}{r} 35 \\ 3 \\ \hline 105 \end{array}$$

34

32 series 8 ohms

$$\begin{array}{r} 85 \\ 85 \\ \hline 425 \\ 680 \\ \hline 7225 \\ 44 \\ \hline 28900 \\ 28900 \end{array}$$

108) 31790.0 (

45
7
3.1.5.

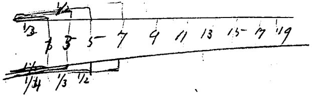
45-

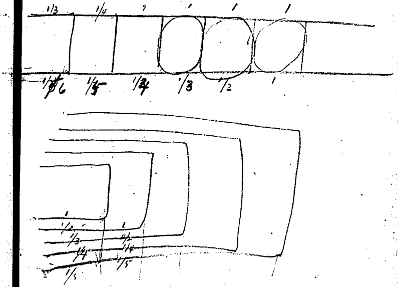
3.

180

42

45

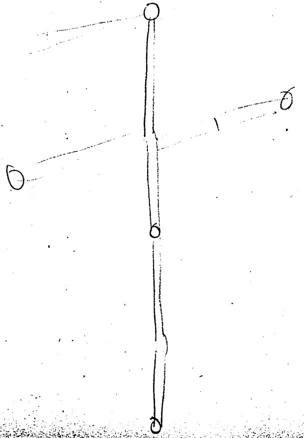

1/4
1/3
1 3 5 7 9 11 13 15 17 19
1/4
1/4
1/3
1/2

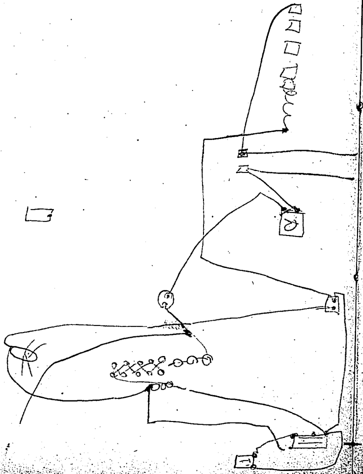

1/3
1/4
1
1
1
1
1/6
1/5
1/4
1/3
1/2
1
1
1/2
1/3
1/4
1/5
1
1/2
1/4
1/5

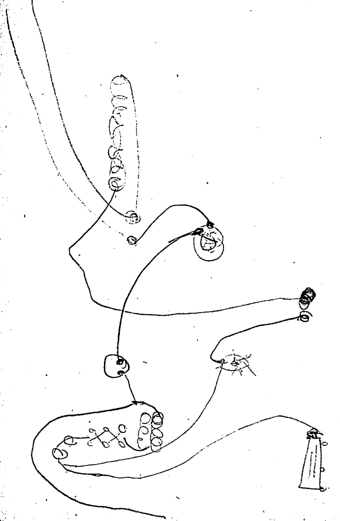
50
50
2500
44
10000
10000
110,075

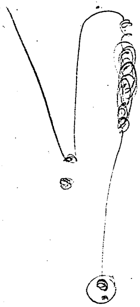
110 000

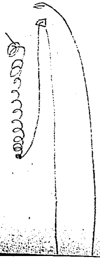
2500
,3
75,00











82

87
150

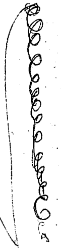
200
175
40
150
90
30
23 2.00
37 50
25

9.60

Primary 3.62 oz

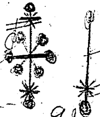
Secondary 1.62
Tertiary 1.125 oz

2 7/5



1000
350
500
1200
4.050

$2\frac{3}{4}$ oz #32 .20
$3\frac{6}{10}$ oz 21 .092



55 ¢
32
87

09 $3\frac{6}{10}$
9
$32\frac{4}{10}$

Switch –	
Key –	9.0
Coil	175
Bell –	150
Binders	40
Box	25
	20
	5.00

Pay five thousand six
to your credit Dubble until
Pay 20.

16/326 | 20.
32
60

2200
660
1520
110
770
320

46½
139

465
139
326
210
63
16/147 | 9.2
144
30

.9.2 c per
.092 per oz